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PATENT APPLICATION

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CASE: CURTIN 11-46-14

TITLE: VEHICLE INTERACTION COMMUNICATION SYSTEM

ASSISTANT COMMISSIONER FOR PATENTS  
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SIR:

Enclosed are the following papers relating to the above-named application for patent:

Specification (including claims and Abstract) - 29 pages  
6 Informal sheets of drawing(s)  
1 Assignment with Cover Sheet  
Declaration and Power of Attorney

CLAIMS AS FILE				
	NO. FILED	NO EXTRA	RATE	CALCULATIONS
Total Claims	44 - 20 =	24	x \$18 =	\$432
Independent Claims	12 - 3 =	9	x \$78 =	\$702
Multiple Dependent Claim(s), if applicable			\$260 =	\$0
Basic Fee				\$690
			TOTAL FEE:	\$1824

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Respectfully submitted,



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# APPLICATION UNDER UNITED STATES PATENT LAWS

Invention: **VEHICLE INTERACTION COMMUNICATION SYSTEM**

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This is a:

- ☐ Provisional Application
- ☒ Regular Utility Application
- ☐ Continuing Application
- ☐ PCT National Phase Application
- ☐ Design Application
- ☐ Reissue Application
- ☐ Plant Application

## SPECIFICATION

# VEHICLE INTERACTION COMMUNICATION SYSTEM

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

5                This invention relates generally to the improved safety of vehicles derived from wireless communications, either from vehicle to vehicle, and/or between a roadside device and a vehicle.

### 2. Background of Related Art

10                In today's vehicles, communications between automobiles is typically accomplished using visual confirmation of external signals (e.g., left turn signal light blinking, right turn signal light blinking, brake light illuminated, etc.) Imminent danger is often signaled by the use of an audible horn. While quite functional, the reception and accurate  
15                interpretation of visual and/or audible signals is dependent entirely on the awareness of the driver at the time that the signals are made. Unfortunately, the requirement for human interpretation and confirmation through visual (or audible) observation requires that a given separation be maintained between vehicles at any given speed to allow for a  
20                comfortable reaction time of the driver. Thus, visual confirmation of signals such as brake lights, of the separation between vehicles in front, behind, and to the sides of the vehicle, road signs, etc., are all subject to the accuracy and speed of human reaction. Any level of inattention can cause accidents in the worst case, or cause traffic jams in a collective  
25                case.

                 For instance, there may be times when a particular driver is not fully perceptive of the external environment surrounding the vehicle, and may as a result either become dangerously close to other vehicles, and/or greatly increase the chances of their causing an accident.

30

As an example, a driver may not see or properly comprehend the intentions of a tailgating vehicle following too closely behind the driver's vehicle when the tailgating vehicle starts their left turn signal signaling their intention to pass in a left hand lane. The driver may not quickly assess such a situation, e.g., perhaps because of the ambiguity inherent with whether the following vehicle is making a left turn or intends to pass, perhaps because the driver's rear view mirror is not properly adjusted for the driver's current seated position, or because the driver is not constantly monitoring their rearview mirror, etc. In any event, the driver may in fact become startled by the appearance of the passing vehicle or worse yet unintentionally make a maneuver which interferes with the passing vehicle and causes an accident, increased separation between vehicles traveling on a common road to compensate for slower reaction time of the driver, and/or significant traffic problems particularly during work rush hours.

Not only is a driver subject to their own visual confirmation of signals from vehicles immediately surrounding their vehicle and their own reaction thereto, a driver may also be heading towards a heavy traffic situation without prior warning but for other visual confirmation (e.g., a visual road sign warning of traffic ahead), all of which add to the density and danger of vehicular travel in today's crowded and fast-paced world.

There is a need to improve the speed and accuracy of information to a driver regarding surrounding vehicles, objects, and/or traffic conditions, and to allow safer and more efficient use of roadways.

## **SUMMARY OF THE INVENTION**

In accordance with the principles of the present invention, a vehicle interaction communication system comprises a wireless transmitter, and a digitized measurement of an operational aspect of a moving vehicle. A controller formats the digitized measurement and

transmits the formatted digitized measurement using the wireless transmitter to a device external to a vehicle including the vehicle interaction communication system.

5 A method of communicating status information between moving vehicles in accordance with another aspect of the present invention comprises measuring an operational aspect of a first vehicle in operation on a roadway. A local area network is established including the first vehicle. The measured operational aspect is transmitted over the local area network.

10 A method of compiling real-time traffic data from moving vehicles in accordance with yet another aspect of the present invention comprises measuring internal vehicle data relating to an operational aspect of a vehicle in operation on a roadway from within a vehicle traveling on the roadway. A temporary network is established with a fixed  
15 transceiver. The measured internal vehicle data is transmitted to the fixed transceiver over the temporary network. The measured internal vehicle data is compiled from a plurality of vehicles as real-time traffic data.

Still another aspect of the present invention relates to a road mounted transmitter comprising a fixed value relating to a current speed  
20 limit. An RF transmitter transmits the fixed value to passing vehicles.

Another aspect of the present invention relates to apparatus comprising a vehicle, and a wireless communication system within the vehicle. The wireless communication system comprises a wireless transmitter, a digitized measurement of an operational aspect of a moving  
25 vehicle, and a controller adapted to format the digitized measurement, and transmit the formatted digitized measurement using the wireless transmitter to an external device.

A method of controlling a vehicle in accordance with yet another aspect of the present invention comprises establishing a local  
30 area network. An operational aspect of a vehicle is received over the

local area network. A driver control of the vehicle is adjusted based on the received operational aspect of the vehicle.

A system for communicating with a passing vehicle on a roadway in accordance with another aspect comprises a wireless transmitter having an antenna in a vicinity of a roadway sign, and sign  
5 identification data for transmission by the wireless transmitter relating to information contained on the roadway sign.

A method for informing a moving vehicle regarding an approaching roadway sign in accordance with another aspect comprises  
10 establishing a local area network with an approaching vehicle, and transmitting information regarding information contained in a roadway sign which the vehicle is approaching.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

15 Features and advantages of the present invention will become apparent to those skilled in the art from the following description with reference to the drawings, in which:

Fig. 1 shows a plurality of vehicles each equipped with a wireless vehicle interaction and control system to communicate status  
20 information regarding a transmitting vehicle, in accordance with the principles of the present invention.

Fig. 2 is a depiction of the dashboard of any one of the vehicles including a vehicle environment controller and a vehicle interaction display, in accordance with the principles of the present  
25 invention.

Fig. 3 shows a block diagram of exemplary sensing, control and data interfaces to a vehicle environment controller, in accordance with the principles of the present invention.

Fig. 4 shows implementation of a broadcast wireless data  
30 transmitter at strategic locations along a road (e.g., corresponding to stop

signs, traffic signals, etc., temporarily establishing a piconet with an approaching vehicle, in accordance with the principles of the present invention.

Fig. 5 shows a traffic flow coordination system utilizing Bluetooth transponders at various checkpoints along a road system, in accordance with the principles of the present invention.

Fig. 6 shows the integration of traffic information received by a vehicle environment controller with a navigational control system to cause, e.g., recalculation of a best route to an intended destination based on real-time traffic conditions including the driven vehicle, in accordance with the principles of the present invention.

## DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

The present invention relates generally to the expansion of information available to a driver of a vehicle using wireless communications (e.g., using Bluetooth wireless communication devices). Information regarding surrounding vehicles (e.g., left turn, right turn, brake light, speed, direction, location) is brought directly into the compartment of the vehicle independent of the need for visual confirmation of the situation by the driver.

In one embodiment, a vehicle is equipped with a short-range communication system, e.g., Bluetooth, which communicates relevant status information with other nearby vehicles, which may include, but is not limited to, position (e.g., GPS), speed, direction, and/or status such as braking, measured slippage, acceleration, deceleration, direction of travel, etc.

Information regarding an adjacent vehicle such as a brake light, a turn light, speed, distance, direction, etc., may be transmitted from one vehicle to a nearby or adjacent other vehicle. The received information is used in any appropriate manner, such as causing the

receiving vehicle to change vehicle speed or brake, to turn to avoid a collision, etc.

In a second embodiment, roadside wireless transceivers collect information regarding passing vehicles, and a central database  
5 compiles the received information and relates it to current, real-time traffic conditions. The real-time traffic condition information can be transmitted back to the passing vehicles while they are in range of the roadside wireless transceivers for appropriate use by the driven vehicle, e.g., causing the driver to slow down, or even causing a navigation device in  
10 the receiving vehicle to manually prompt for recalculation of, or automatically recalculate without prompting, a best route to an intended destination.

In yet another embodiment, broadcast transmitters can be established at signs and other significant locations transmitting data  
15 information to passing vehicles for display on a driver's console. The broadcast information may be as simple as indicating the existence of the sign, which would be particularly useful in a wooded or curvy portion of highway where the sign may be hidden due to overgrowth. Moreover, depending upon the range of the particular wireless transmitter, the  
20 existence of a particular sign, bump in road, curve, etc., can be forewarned far in advance of when the driver will actually see the relevant object. Still further, the information received could be checked against actual vehicle operation to check for driver compliance, and apply corrective action as necessary and/or desired. As an example, corrective  
25 action may include the application of brakes when the vehicle is approaching a curve or stop sign.

Alternatively, the broadcast information may be quite detailed, e.g., containing a detailed itemization and directions to a large number of gas stations, restaurants, etc., reachable from a particular exit



from a highway. In such a case, a driver might scroll through a textual display of the received road data.

Fig. 1 shows a plurality of vehicles each equipped with a wireless vehicle interaction and control system to communicate status information regarding a transmitting vehicle, in accordance with the principles of the present invention.

In particular, in Fig. 1, three vehicles **102**, **104**, **106** are shown traveling along a common roadway **103**, and temporarily establish a wireless network using any appropriate wireless technology. For example, in the given embodiments, the three vehicles **102**, **104**, **106** form a local network, such as a piconet using Bluetooth protocols and technology. Of course, the principles of the present invention relate to any appropriate short or medium range wireless technology and/or protocols exchanged between moving vehicles.

Thus, in accordance with the principles of the present invention, Bluetooth or other short range RF communication systems are advantageously, but not necessarily, integrated with status and navigation sensing devices within each vehicle **102-106** and provide the sensed status information to the other appropriately equipped vehicles within range of the transmitting vehicle.

Preferably, the status information is updated and retransmitted periodically, e.g., every 1 second, every ½ second, etc., once the vehicle begins operation or when a condition in the vehicle changes, such as brake application, etc. The status information is transmitted to adjacent vehicles and/or objects within range of the transmitting vehicle.

Information about the Bluetooth wireless standard is occasionally revised, and can currently be obtained from the website [www.bluetooth.com](http://www.bluetooth.com). Currently, the Bluetooth standard is a short range technology with a range of, e.g., 10-30 meters. However, longer range

capabilities of this and other wireless standards are planned and applicable to the present invention.

Generally speaking, the longer the wireless range of the transmitting devices, the faster relative speeds between vehicles (or between a vehicle and an object) may be accommodated. For instance, with a 10-30 meter range, communications between vehicles traveling in a common direction along a common road and nearby stationary transceivers may be the most practical. However, using wireless transceivers in the vehicles with larger range communications, e.g., ½ kilometer, communications between passing vehicles is more practical as well as with stationary transceivers.

As shown in the given example of Fig. 1, two vehicles **102**, **106** are traveling in a left hand lane, and a third vehicle **104** is traveling in a right hand lane. Each of the vehicles **102-106** include a wireless vehicle environment controller **100** in accordance with the principles of the present invention.

Fig. 2 is a depiction of the dashboard of any one of the vehicles **102-106** including a vehicle environment controller **100** and a vehicle interaction display **204**, in accordance with the principles of the present invention.

In particular, in Fig. 2, a wireless vehicle environment controller **100** includes a radio frequency (RF) transceiver front end including an antenna **207**, an appropriate processor (e.g., a microprocessor, microcontroller, and/or digital signal processor (DSP)), and input/output signals to various sensing and/or control interfaces within the vehicle, including a display **204**.

The display **204** may be graphical and/or textual in nature, but in any event desirably conveys (but is not essential to convey) status information received from an adjacent vehicle or object. As shown in Fig. 2, the display includes a graphical representation of the driven vehicle,

with other vehicles **102**, **106** within range and within the established local network (e.g. piconet) in appropriate positions with respect to the displayed image of the driven vehicle **104**.

For instance, the display **204** shown in Fig. 2 may include a  
5 phantom of a vehicle behind, of a vehicle ahead, of a vehicle to the left, and of a vehicle to the right of the driver's vehicle, in moving relation to an image of the driven vehicle **104** in the center of the display. In response to the reception of a wireless signal (e.g., Bluetooth data) from any or all of the surrounding vehicles, the display of the drivers vehicle may be  
10 updated with a relative position of the relevant surrounding vehicle. Other information such as imminent collision, relative speed between vehicles, direction with respect to the driven vehicle, etc., can also be displayed.

Thus, as an example, if the driven vehicle receives Bluetooth data from a following vehicle indicating that it is exhibiting a left  
15 turn signal together with a closing distance and common direction, an appropriate processor (e.g., navigation system) in the driven vehicle can interpret such external actions as an intention to pass the driven vehicle, and can so indicate the same to the driver (either by visual display on a panel, on a heads-up display projected onto the windshield, by audible  
20 warning, etc.). Thus, the driver would be informed of a passing vehicle without having seen the vehicle themselves, either in the mirror or through a window.

In accordance with the principles of this aspect of the invention, aside from positional status information determined from, e.g.,  
25 global positioning system (GPS) information relating to the transmitting vehicle, other status information may be displayed. For instance, the transmitting vehicle's speed, direction, acceleration, blinker status, braking status, etc., may additionally or alternatively be sensed by the transmitting vehicle, transmitted in data form using the Bluetooth RF transceiver from  
30 each of the vehicles, and displayed for the drivers of the in-range vehicles.

In a more sophisticated expansion of speed information transmitted to a surrounding vehicle, a new type of cruise control can be set to maintain the same actual speed of the preceding vehicle as received through Bluetooth data communications from the vehicle in front,  
5 instead of to a fixed speed as in conventional cruise control devices.

For instance, in accordance with the principles of the present invention, the status information from adjacent vehicles may be input to a cruise control device **210** in the driven vehicle **104**. For instance, the speed of a forward vehicle in a same lane as the driven  
10 vehicle may be used to base the cruise-controlled speed of the driven vehicle **104** in a variable manner such that a constant distance is maintained between a car in front of the driven vehicle **104** and the driven vehicle **104** (rather than constant speed cruise control as in conventional vehicles). Further, the vehicle **104** may be fully controlled via steering  
15 controls **310**, accelerator control **314**, braking control **316**, and engine controls **312**, to provide safer vehicle (automatic) control. Using such automated cruise control, a driver's confidence and safety may be increased by providing a means other than simple visual observation and confirmation of changes in the forward vehicle's speed, causing an  
20 immediate change in spacing between the moving vehicles. In this way, more vehicles may be packed into a given stretch of highway with smaller (yet safer) separation between each vehicle, still maintaining a same given level of safety because as a lead vehicle brakes, so too will a following vehicle using the automated cruise control **210**.

25 Detailed position information can also be provided, e.g., information relating to which lane is being occupied, as can vehicle performance information.

Using the vehicle environment controller **100** in accordance with the principles of the present invention, vehicles can interact with one

another to achieve a specific goal. The specific goal can be, e.g., best speed, high density, or other desired result.

In addition to general traffic flow information, emergency causing information and control may also be accomplished. For instance,  
5 information regarding braking communicated between vehicles would allow vehicles in a vulnerable position (e.g., behind or to the side of the braking vehicles) to be immediately informed of the braking status, allowing a quick reaction by the driver of the affected vehicle to compensate or apply emergency braking (based on acceleration data) to  
10 maintain a desired separation between vehicles.

Because of the short range nature of low power wireless communications systems, such as Bluetooth, multiple mobile local networks between vehicles can be implemented to convey accurate, current road and traffic conditions to, e.g., rearward vehicles or to  
15 opposing traffic.

Inter-vehicle, short range, voice communication can also be provided. For instance, the Bluetooth wireless communication protocol includes capability for the transmission of audio. Thus, using the audio capability and appropriate analog-to-digital and digital-to-analog  
20 conversion circuitry, and appropriate encoding and decoding algorithms as desired in the vehicles, voice communications can be supported between two vehicles certainly within a single local network, and even between two separate vehicles via an appropriate local network bridging device between two separate local networks.

25 Other advances can be made in vehicle safety given the wireless communication (e.g., a piconet such as Bluetooth) between vehicles as they become within range of one another on a particular road. For instance, the speed of a surrounding vehicle can be transmitted to other vehicles in range, to allow a driver to adjust their speed accordingly.  
30 In a simpler case, acceleration or deceleration information regarding the

vehicle in front, either in absolute terms and/or relative to the driver's vehicle, can be indicated, e.g., using an UP arrow (accelerating) or DOWN arrow (decelerating).

Fig. 3 shows a block diagram of exemplary sensing, control  
5 and data interfaces to a vehicle environment controller **100**, in accordance with the principles of the present invention.

In particular, as shown in Fig. 3, various input/output devices are interfaced with the vehicle environment controller **100**, which receives and transmits status data regarding interacting vehicles within range of  
10 one another through a radio frequency (RF) transceiver **308**.

For instance, various devices within the driven vehicle can be sensed, with a digital output being formatted using an appropriate protocol (e.g., Bluetooth) and transmitted using an RF wireless transmitter to all other vehicles within range. Exemplary devices for sensing include  
15 a speedometer and/or odometer **302**, a global positioning system (GPS) **306**, often comprised within a navigational system in the driven vehicle. A compass and/or gyroscope and acceleration (inertial navigation system) may be included as an alternative to the GPS **306**, to provide useful information to adjacent or otherwise in-range vehicles.

20 The GPS **306** may be included within the transmitting vehicle to provide exact location, direction and speed information. GPS information may also or alternatively be used to calibrate any inertial navigation systems.

Status data received from other vehicles within the piconet  
25 (and/or from roadside transceivers) can be appropriately displayed on a display **204** (and/or audibly provided to the driver).

As described above, the speed of a cruise control system **210** can be controlled in a variable fashion using speed information received from a vehicle in front of the driven vehicle.

For safety purposes, critical controls of the vehicle may be overridden as determined by the vehicle environment controller 100. For instance, the braking system 316, the accelerator control 314, and/or other engine controls 312, and even steering controls 310 may be enabled, disabled, or even variably controlled, based on information received from other vehicles.

A radar device may be included to allow a desired separation distance between fore/aft and/or side/side vehicles. The radar device may be of the traditional RF type. Alternatively, a Bluetooth transponder may be utilized to allow the measurement of round-trip delay times or received signal strength indicator (RSSI) of the return signal to provide rudimentary ranging information in lieu of a radar system.

Fig. 4 shows implementation of a broadcast wireless data transmitter at strategic locations along a road (e.g., corresponding to stop signs, traffic signals, etc., temporarily establishing communication with an approaching vehicle, in accordance with the principles of the present invention.

A simple use of Bluetooth communications in vehicular use is the communication of simple directional or sign information transmitted from a stationary roadside transmitter to passing vehicles when they become within range.

For instance, there are times at which ambient or environmental conditions (e.g., fog, nighttime, tree growth obstructing the sign, faded sign, etc.) cause difficulty in the visual confirmation of a particular sign, road curve, etc. In accordance with this aspect of the present invention, critical signs, road aspects, objects, locations, etc., can be equipped with appropriate wireless short range broadcast transmitters (e.g., Bluetooth transmitters), and repeatedly output data relating to the relevant information (e.g., a stop sign ahead, turn ahead, reduced speed, etc.)

In particular, as shown in Fig. 4, a vehicle including a vehicle environment controller **100** including an RF receiver, and a display **204**, is shown approaching a stop sign **702** totally obstructed by a tree **704**. Ordinarily, the driver of the vehicle might not actually observe the stop sign until they turn the corner around the tree **704**. However, in accordance with the principles of the present invention, data transmitted by an appropriately placed Bluetooth (or other protocol) RF transmitter **700** is received, processed, and provided to the driver using, e.g., a display of a stop sign, textually indicating "stop sign", or other technique in the driven vehicle.

As another example, a wireless data transmitter may be associated with a speed limit sign. The wireless data transmitter may be placed in a broadcast mode for reception by any/all approaching and passing vehicles.

The speed limit information may be digitally received by approaching or passing vehicles, and referred to at the driver's pleasure. For instance, if the driver was not cognizant of the last approached speed limit sign as it was passed, the speed limit information may be retained by the vehicle and presented to the driver when the driver is requiring such information.

The speed limit information retained by the vehicle may be refreshed by new speed limit signs as they are passed.

In operation, the wireless data transmitter may be set near a speed limit sign. Then, a particular speed limit of a roadway on which a vehicle is traveling may be digitally received by the vehicle as it approaches and passes a particular broadcast wireless data transmitter. The digitally received speed limit may be displayed in the vehicle for the driver's reference.

Moreover, the digitally received speed limit may be the basis for a derivative display. For example, the difference between a current



rate of speed of the approaching or passing vehicle and the relevant speed limit for that stretch of roadway digitally received by the approaching or passing vehicle may be displayed for the driver's reference.

5           The difference between the current rate of speed may be used to control a governor which limits the rate of speed of the vehicle. Thus, automatic control of acceleration may be gained as a vehicle travels over various roadways having differing speed limits.

10           Further advances may allow any driver control (e.g., braking, acceleration, steering, blinker activation, horn activation, etc.) to be automatically adjusted based on information received over a wireless network, in accordance with the principles of the present invention.

15           Fig. 5 shows a traffic flow coordination system utilizing transponders at various checkpoints along a road system, in accordance with the principles of the present invention.

          Short range transceivers along roadway can collect detailed vehicle status information from traveling vehicles, to provide traffic data back to traveling vehicles.

20           Exemplary status information includes, but is not limited to, lane, road, location, distance information. Exemplary transponder communication information includes, e.g., information regarding the steered direction of a querying vehicle as it approaches or recedes from the embedded lane marker.

25           For instance, roadside transceivers may query passing vehicles for status information, e.g., speed, direction, route, etc., and compile the same in a traffic database or other information compilation.

          A centralized computer can collect all information from the passing vehicles to determine actual traffic conditions for relevant roadways.

The traffic information determined directly from passing vehicles can be fed back to the same or other traveling vehicles, with suggestive or automated navigation control information.

For instance, a navigation system in a passing vehicle may  
5 utilize the received traffic information to determine automated control information for aspects of the vehicle, e.g., to limit a maximum speed of the vehicle, or to provide speed adjustment data and/or alternative directions to a destination, to maintain a smooth traffic pattern.

Also, information passed to the vehicles may relate to the  
10 suggestion of an alternative route to be taken by the vehicle, with or without mandating specific maximum speeds or other aspects of the vehicle.

Such a navigation system aids in the administration of traffic flow, avoids the formation of traffic jams, and/or has the capability to route  
15 traffic away from problem areas.

The roadside transceivers can also provide warning information to vehicles regarding approaching and overtaking emergency vehicles, so that the vehicles may more readily be informed of the approaching emergency vehicle and yield to the oncoming emergency  
20 vehicle at an earlier time.

The roadside transceivers can also or alternatively provide a data download of traffic information to resident navigational computers inside vehicles, prompting the navigational computers to recalculate a best route to the desired destination given the current or expected traffic  
25 conditions. Alternatively, a centralized computer system can calculate the best route (e.g., shortest time, shortest distance, best views, etc.) for a particular vehicle in view of the overall traffic 'picture'.

In accordance with the principles of this aspect of the present invention, vehicles can adapt quickly to the state of nearby  
30 vehicles.

Fig. 6 shows the integration of traffic information received by a vehicle environment controller **100** with a GPS navigational control system **202** to cause, e.g., recalculation of a best route to an intended destination presented by the GPS navigational control system **202** based on real-time traffic conditions including the driven vehicle received from a roadside transponder, in accordance with the principles of the present invention.

In addition, a navigation computer in the vehicle can be responsive to signals received from lane markers embedded in a roadway being traveled. The embedded lane markers may be passive devices which provide indication to the vehicle as to the relationship to the appropriate lane of roadway.

The embedded lane markers may be, e.g., optical devices and/or reflective devices sensed by an appropriate light source and/or detector mounted on the vehicle. In another embodiment, the embedded lane markers may be, e.g., electromagnetic devices which output a particular signal in response to an electromagnetic stimulation output by the vehicle as it passes.

The embedded lane markers may be sensed by an appropriate lane sensor **321** (Fig. 3) in communication with the vehicle environment controller **100**. The relationship of the vehicle with respect to the lane as determined by the lane sensor **321** may be used to keep the vehicle within the bounds of the lane and/or appropriately distant from adjacent vehicles.

Control of vehicle navigation in accordance with this aspect of the present invention provides for a more efficient regulation of traffic flow.

While the invention has been described with reference to the exemplary embodiments thereof, those skilled in the art will be able to

make various modifications to the described embodiments of the invention without departing from the true spirit and scope of the invention.

## CLAIMS

What is claimed is:

- 5                   1. A vehicle interaction communication system, comprising:  
                  a wireless transmitter;  
                  a digitized measurement of an operational aspect of a  
moving vehicle; and  
                  a controller adapted to format said digitized measurement  
and transmit said formatted digitized measurement using said wireless  
10               transmitter to an external device.
2. The vehicle interaction communication system according  
to claim 1, further comprising:  
                  a wireless receiver in an adjacent vehicle; and  
15               a display in said adjacent vehicle adapted to display a  
parameter relating to said digitized measurement.
3. The vehicle interaction communication system according  
to claim 1, further comprising:  
20               a wireless receiver adapted to receive a signal from a  
wireless transmitter fixed to a roadway.
4. The vehicle interaction communication system according  
to claim 3, further comprising:  
25               a database compiled from received measurements from a  
plurality of moving vehicles received when each of said plurality of moving  
vehicles are within range of said wireless receiver.

5. The vehicle interaction communication system according to claim 1, wherein:

said operational aspect of said moving vehicle is a current speed of said moving vehicle.

5

6. The vehicle interaction communication system according to claim 1, wherein:

said operational aspect of said moving vehicle is a current direction of said moving vehicle.

10

7. The vehicle interaction communication system according to claim 1, wherein:

said operational aspect of said moving vehicle is a location of said moving vehicle.

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8. The vehicle interaction communication system according to claim 1, wherein:

said operational aspect of said moving vehicle is an indication of braking of said moving vehicle.

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9. The vehicle interaction communication system according to claim 1, wherein:

said operational aspect of said moving vehicle is an indication of measured slippage of at least one wheel of said moving vehicle.

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10. The vehicle interaction communication system according to claim 1, wherein:

said operational aspect of said moving vehicle is an indication of a lane occupied by said moving vehicle.

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11. The vehicle interaction communication system according to claim 1, wherein:

said operational aspect of said moving vehicle is an indication of performance of said moving vehicle.

5

12. The vehicle interaction communication system according to claim 1, wherein:

said wireless transmitter utilizes a Bluetooth protocol.

10

13. The vehicle interaction communication system according to claim 1, further comprising:

a wireless receiver; and

a display adapted to display a parameter relating to an operational aspect of an another vehicle.

15

14. The vehicle interaction communication system according to claim 1, further comprising:

a navigational system in communication with said controller, said navigational system being automatically responsive to traffic data received over said wireless receiver without driver intervention.

20

15. A method of communicating status information between moving vehicles, comprising:

measuring an operational aspect of a first vehicle in operation on a roadway;

25

establishing a local area network including said first vehicle;

and

transmitting said measured operational aspect over said local area network.

30

16. The method of communicating status information between moving vehicles according to claim 15, wherein:

said measured operational aspect is transmitted to a second vehicle in operation on said roadway.

5

17. The method of communicating status information between moving vehicles according to claim 15, wherein:

said second vehicle is adjacent said first vehicle.

10

18. The method of communicating status information between moving vehicles according to claim 15, wherein:

said second vehicle is within about 30 meters of said first vehicle.

15

19. The method of communicating status information between moving vehicles according to claim 15, wherein:

said operational aspect is a signal light status.

20

20. The method of communicating status information between moving vehicles according to claim 15, wherein:

said operational aspect is an operational speed.

25

21. The method of communicating status information between moving vehicles according to claim 15, further comprising:

establishing a temporary communication network between said first vehicle and said second vehicle.



22. The method of communicating status information between moving vehicles according to claim 15, further comprising:

establishing a communication network between a plurality of vehicles in motion on a roadway.

5

23. The method of communicating status information between moving vehicles according to claim 22, wherein:

said communication network is a Bluetooth piconet.

10

24. The method of communicating status information between moving vehicles according to claim 15, wherein:

said step of transmitting utilizes a Bluetooth protocol.

15

25. A method of compiling real-time traffic data from moving vehicles, comprising:

establishing a temporary network with a transceiver in a moving vehicle;

causing measured internal vehicle data relating to an operational aspect of a vehicle in operation on a roadway from within said

20

vehicle traveling on said roadway;

transmitting said measured internal vehicle data to said fixed transceiver over said temporary network; and

compiling said measured internal vehicle data from a plurality of vehicles as real-time traffic data.

25

26. Apparatus for communicating status information between moving vehicles, comprising:

means for measuring an operational aspect of a first vehicle in operation on a roadway; and

5 means for transmitting said measured operational aspect to a second vehicle in operation on said roadway.

27. Apparatus for compiling real-time traffic data from moving vehicles, comprising:

10 means for establishing a temporary network with a transceiver in a moving vehicle;

means for causing measured internal vehicle data relating to an operational aspect of a vehicle in operation on a roadway from within said vehicle traveling on said roadway;

15 means for transmitting said measured internal vehicle data to said fixed transceiver over said temporary network; and

means for compiling said measured internal vehicle data from a plurality of vehicles as real-time traffic data.

20 28. A road mounted transmitter, comprising:

a fixed value relating to a current speed limit; and

an RF transmitter adapted to transmit said fixed value to passing vehicles.

25 29. The road mounted transmitter according to claim 28, wherein:

said RF transmitter is adapted to establish a local area network with a passing vehicle.

30. The road mounted transmitter according to claim 29,  
wherein:

said local area network is a piconet.

5 31. The road mounted transmitter according to claim 28,  
wherein:

said RF transmitter utilizes a Bluetooth protocol.

10 32. Apparatus comprising:

a vehicle; and

a wireless communication system within said vehicle, said  
wireless communication system comprising:

a wireless transmitter,

15 a digitized measurement of an operational  
aspect of a moving vehicle, and

a controller adapted to format said digitized  
measurement and transmit said formatted digitized  
measurement using said wireless transmitter to a device  
external to a vehicle including said vehicle interaction  
20 communication system.

33. A method of controlling a vehicle, comprising:  
establishing a local area network;  
receiving an operational aspect of a vehicle over said local  
25 area network; and

adjusting a driver control of said vehicle based on said  
received operational aspect of said vehicle.

34. The method of controlling a vehicle according to claim 33, wherein said adjusted driver control comprises at least one of:

acceleration of said vehicle;  
braking of said vehicle; and  
steering of said vehicle.

35. The method of controlling a vehicle according to claim 33, wherein said adjusted driver control comprises:

a display for use of a driver of said vehicle.

36. A system for communicating with a passing vehicle on a roadway, comprising:

a wireless transmitter having an antenna in a vicinity of a roadway sign; and

sign identification data for transmission by said wireless transmitter relating to information contained on said roadway sign.

37. The system for communicating with a passing vehicle on a roadway according to claim 36, wherein:

said wireless transmitter includes a receiver; and  
said wireless transmitter and receiver establishing a local area network with an approaching vehicle.

38. The system for communicating with a passing vehicle on a roadway according to claim 36, wherein:

said roadway sign is a stop sign; and  
said data relates to a directive for an approaching vehicle to stop.

39. The method for informing a moving vehicle regarding an approaching roadway sign according to claim 36, wherein:

said roadway sign is a speed limit sign; and

5      said data relates to a speed directive for an approaching vehicle.

40. A method for informing a moving vehicle regarding an approaching roadway sign, comprising:

10      establishing a local area network with an approaching vehicle; and

transmitting information regarding information contained in a roadway sign which said vehicle is approaching.

41. The method for informing a moving vehicle regarding an approaching roadway sign according to claim 40, further comprising:

15      displaying in said approaching vehicle a relevant speed limit received over said local area network.

42. The method for informing a moving vehicle regarding an approaching roadway sign according to claim 40, further comprising:

20      displaying in said approaching vehicle a difference between a current rate of speed of said approaching vehicle and said relevant speed limit received over said local area network.

43. Apparatus for informing a moving vehicle regarding an approaching roadway sign, comprising:

25      means for establishing a local area network with an approaching vehicle; and

30      means for transmitting information regarding information contained in a roadway sign which said vehicle is approaching.

44. A method for controlling a vehicle, comprising:  
establishing a wireless network between at least two moving  
vehicles;

communicating at least one operational aspect of a first  
5 moving vehicle to a second, adjacent moving vehicle;

automatically adjusting at least one driver control of said first  
moving vehicle based on at least one operational aspect of said second,  
adjacent moving vehicle.

10

## ABSTRACT

The information available to a driver of a vehicle is greatly expanded using wireless communications (e.g., using Bluetooth wireless communication devices). In one embodiment, information regarding an adjacent vehicle such as a brake light, a turn light, speed, distance, direction, etc., is transmitted from one vehicle to a nearby or adjacent other vehicle. The received information is used in any appropriate manner, such as causing the receiving vehicle to change vehicle speed or brake, to turn to avoid a collision, etc. In a second embodiment, roadside wireless transceivers collect information regarding passing vehicles, and central database is compiled relating to a traffic conditions. The traffic condition information can be passed back to the passing vehicles for appropriate use, e.g., causing the driver to slow down, or even causing a navigation device in the receiving vehicle to manually prompt for or automatically recalculate a best route to an intended destination. In yet another embodiment, broadcast transmitters can be established at signs and other significant locations transmitting information to passing vehicles. The broadcast information may be as simple as indicating the existence of the sign, or depending upon the range of the particular wireless transmitter, the existence of a particular sign, bump in road, curve, etc., can be forewarned far in advance of when the driver will actually see the relevant object. Alternatively, the broadcast information may be quite detailed, e.g., containing a detailed itemization and directions to a large number of gas stations, restaurants, etc., reachable from a particular exit from a highway.

FIG. 1

FIG. 1





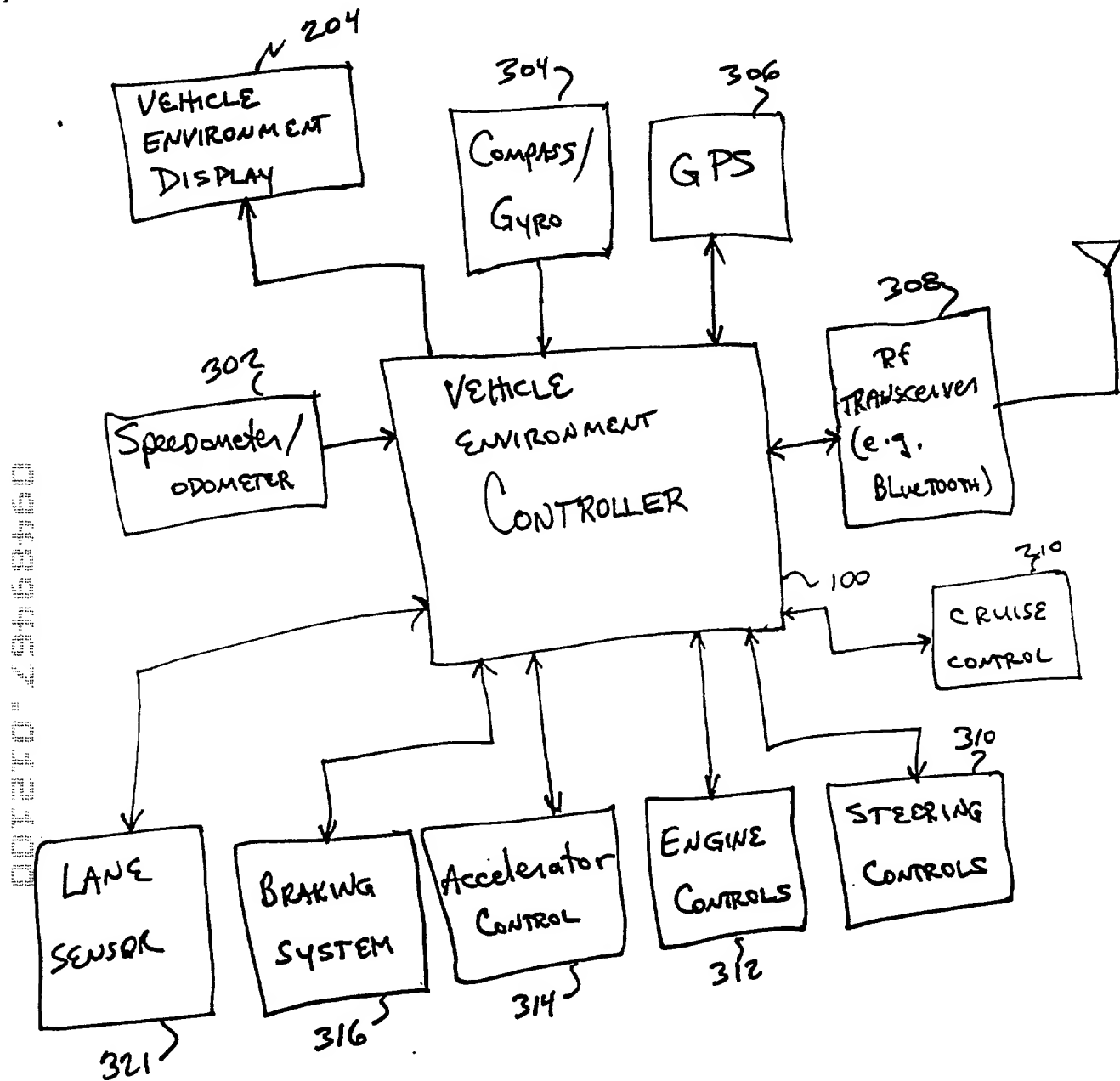


FIG. 3

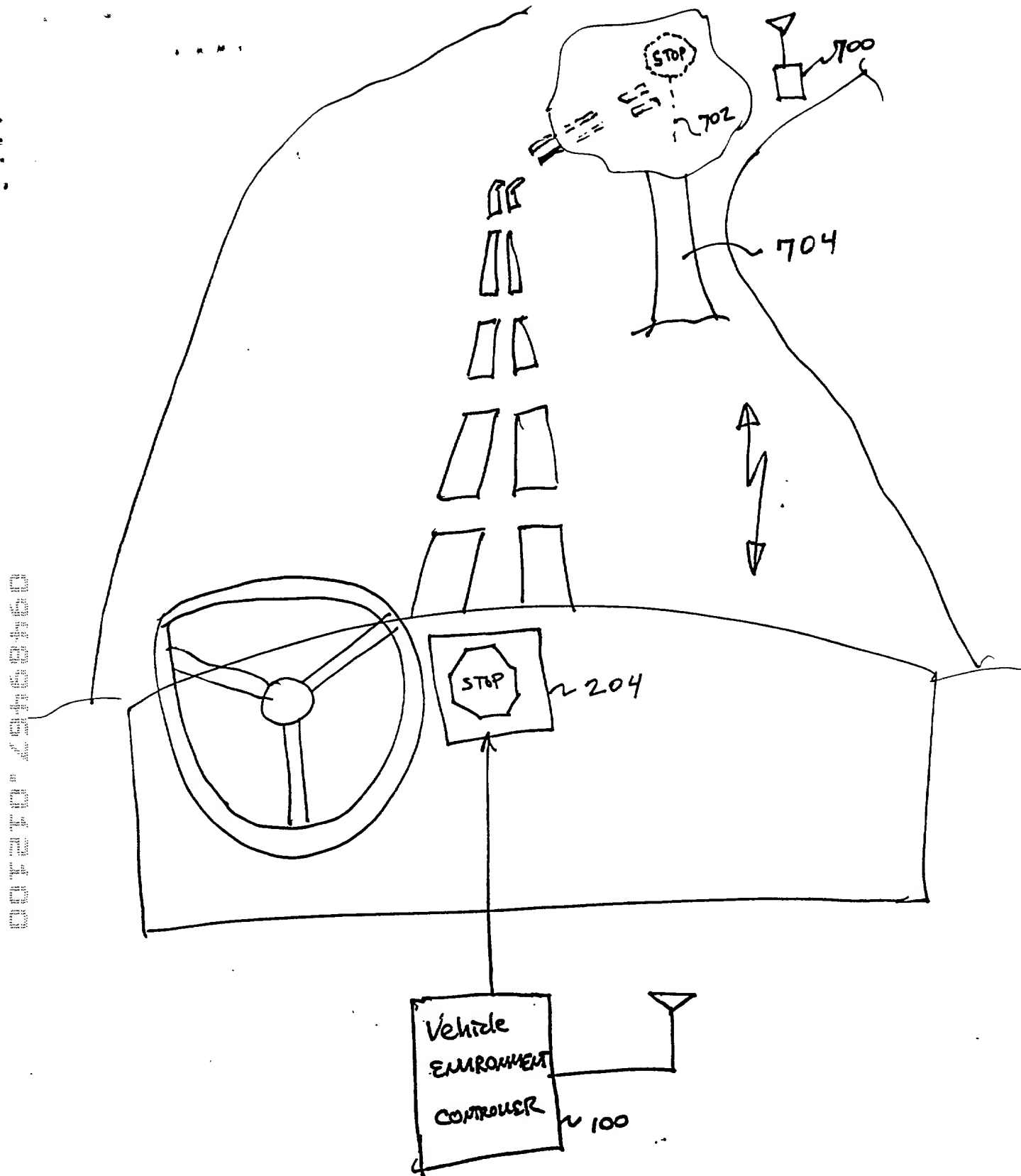


FIG. 4

A hand-drawn schematic diagram illustrating a vehicle communication system. A vehicle, labeled 500, is shown on a road, labeled 502. The vehicle is equipped with an antenna, labeled 510, and a transceiver, labeled 504. A dashed line, labeled 504, represents a communication link between the vehicle's transceiver and a Central Processor, labeled 516. The Central Processor is also connected to a base station, labeled 510, via a solid line. The entire system is enclosed within a dashed boundary.

FIG. 5

Hand-drawn schematic diagram of a vehicle environment control system. A central box labeled "Vehicle Environment Controller ~100" is connected to a steering wheel, a traffic display box labeled "TRAFFIC 3 MILES AHEAD ~204", and a control panel labeled "~202". The control panel shows a screen with a mountain and an arrow, and three buttons below it. A antenna is also connected to the controller box.

FIG. 6

IN THE UNITED STATES  
PATENT AND TRADEMARK OFFICE

Declaration and Power of Attorney

As the below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

We believe we are the original, first and joint inventors of the subject matter which is claimed and for which a patent is sought on the invention entitled **VEHICLE INTERACTION COMMUNICATION SYSTEM** the specification of which is attached hereto.

We hereby state that we have reviewed and understand the contents of the above identified specification, including the claims, as amended by an amendment, if any, specifically referred to in this oath or declaration.

We acknowledge the duty to disclose all information known to me which is material to patentability as defined in Title 37, Code of Federal Regulations, 1.56.

We hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

None

We hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, 112, we acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

None

We hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

We hereby appoint the following attorney(s) with full power of substitution and revocation, to prosecute said application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith:

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We hereby appoint the attorney(s) on ATTACHMENT A as associate attorney(s) in the aforementioned application, with full power solely to prosecute said application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent and Trademark Office connected with the prosecution of said application. No other powers are granted to such associate attorney(s) and such associate attorney(s) are specifically denied any power of substitution or revocation.

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My Commission Expires October 11, 2000  
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